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IN31A-1734 Development and Evaluation of a Gridded CrIS/ATMS Visualization for Operational Forecasting

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BACKGROUND

- Cross-track Infrared Sounder (CrIS) and Advanced Technology Microwave Sounder (ATMS) data are used to create T and q soundings using the NOAA Unique Combined Atmospheric Processing System (NUCAPS) algorithm
- NUCAPS soundings are currently ingested into the NOAA National Weather Service (NWS) Advanced Weather Interactive Processing System (AWIPS; Fig. 1) allowing for generation of Skew-T diagrams (Fig. 2)
- However, Skew-T generation can be tedious due to "point and click" requirement for plotting soundings; forecasters have expressed a need for plan-view and cross-section plots of these data for model comparison

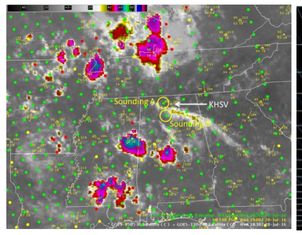

Fig. 1. Current NUCAPS operational product showing sounding locations (green, yellow, and red dots indicating sounding QC) overlaying GOES IR imagery in NWS AWIPS system.

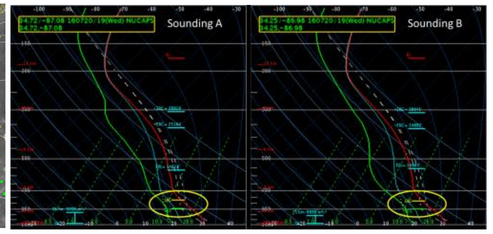

Fig. 2. Sample Skew-Ts generated in AWIPS at the circled sounding locations labeled Sounding A and Sounding B in Fig. 1. These Skew-Ts exhibit the smooth nature of viewing the vertical soundings, especially near in the planetary boundary layer.

DEVELOPMENT OF GRIDDED NUCAPS VISUALIZATION FOR AWIPS

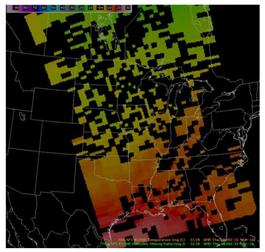

Fig. 3. Sample Gridded NUCAPS temperature field in viewed in AWIPS

- Solution to allow users to view pressure-level data and cross sections
- Real-time NUCAPS retrieval files in HDF format are processed at the direct broadcast sites at UW/CIMSS and UAF/GINA
- SPoRT obtains these retrievals and uses the CIMSS-developed polar2grid software package to convert the raw HDF files to a GRIB2 format for visualization within the AWIPS volume browser (Fig. 3)
- These GRIB2 files are then disseminated by SPoRT via Local Data Manager to NWS partners involved in targeted assessments (see below)
- The Gridded NUCAPS can then be used side-by-side with to other operational observations (e.g., METARs, flight data) and analysis or model data

COLD AIR ALOFT FORECAST CHALLENGE: EVALUTION AT ALASKA AVIATION OFFICES

- Cold Air Aloft (CAA; -65°C and below) is potentially hazardous to aircraft due to the threat of fuel crystalizing
- In data sparse Alaska, forecasters traditionally rely on analysis/model fields, limited radiosonde observations, and pilot reports to nowcast the 3D extent of the CAA
- Gridded NUCAPS will allow forecasters to observe CAA in real-time where conventional observations are lacking in order to gain confidence in and analysis/model or use instead of a questionable analysis/model
- Figure 4 shows plan view (a) and cross section (b) capabilities in AWIPS along with color curve which highlights temperatures below -65ºC, allowing forecasters to quickly identify the 3D extent of CAA

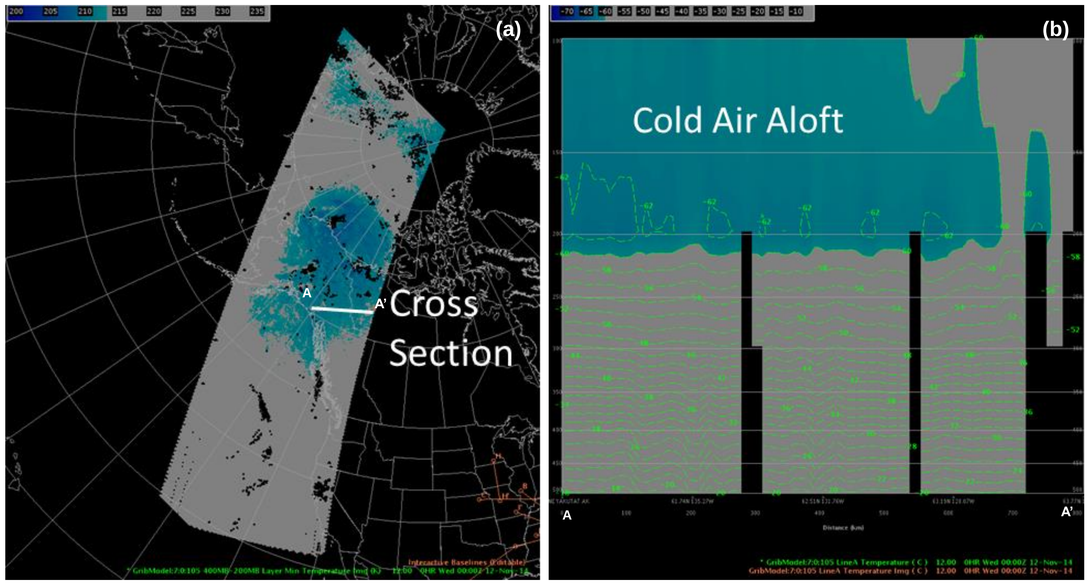

Fig. 4. Gridded NUCAPS visualization for a CAA event in November 2014 for (a) plan view at 400 hPa and (b) cross section along transect labeled A-A' shown in (a).

CONVECTIVE POTENTIAL FORECAST CHALLENGE: EVALUATION AT HAZARDOUS WEATHER TESTBED

- NWS forecasters at the Storm Prediction Center issue severe weather watches; they use a combination of models and observations to determine atmospheric temperature and moisture characteristics
- Lapse rates and vertical distribution of moisture, which are observed by CrIS/ATMS are used to understand the instability of the lower atmosphere, which leads to convection and severe weather
- NWS and broadcast forecasters participated in an evaluation of the Gridded NUCAPS product at the Hazardous Weather Testbed (HWT); forecasters found the plan view and cross section capabilities helpful in identifying frontal boundaries (Fig. 5) and mid-level moisture (Fig. 6) (see feedback in green below)

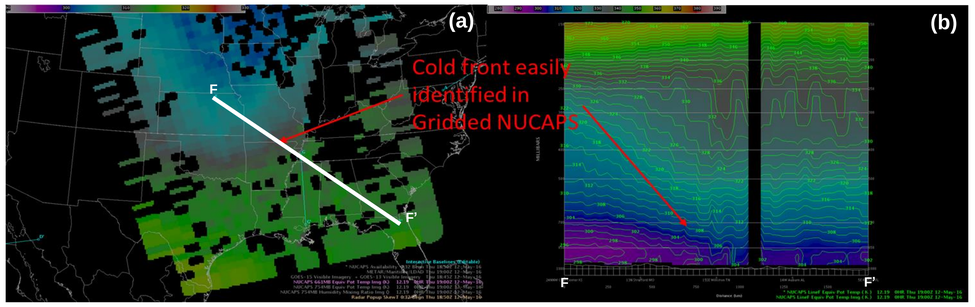

Fig. 5. Gridded NUCAPS visualization for a cold front associated with convection that occurred over the southeast United States on 12 May 2016. Equivalent potential temperature is shown in (a) plan view at 661 hPa and (b) cross section along transect labeled F-F' in (a).

HWT Participant feedback:

- *"[Gridded NUCAPS] will be helpful for diagnosing phenomena such as boundaries and convective instability…Obvious is the much cooler, drier air behind the cold front (low theta-e) with moist, warmer air ahead of it to the east (high theta-e)…The cross-section depicts theta-e vertically through the atmosphere. This provides another perspective on the cold front, which is obvious in the image."*
- *"This is a cool way to visualize the location and structure of a frontal boundary!"*

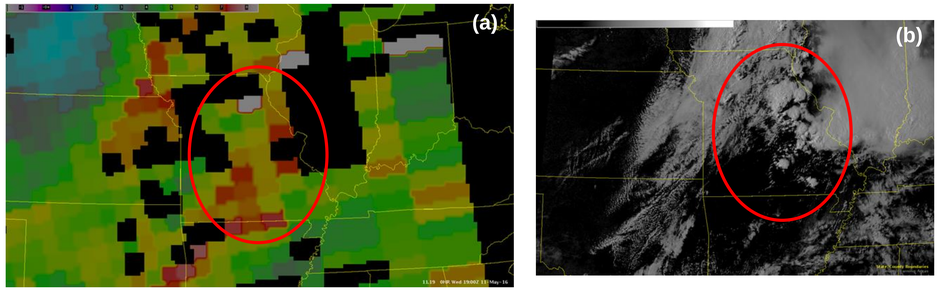

Fig. 6. Gridded NUCAPS plan view visualization of 754 hPa mixing ratio (a) at 1900 UTC on 13 May 2016 shows area of higher mid-level moisture over central and southern Missouri. This area proved to be the location of initiated convection as shown in the GOES visible imagery a few hours later (b).

HWT Participant feedback:

- *"Areas of higher moisture were apparent over south-central Missouri in our SGF CWA, and over the St. Louis metro area. Several hours later, we noted that convective activity was focused in these general areas. The few cells that developed over our CWA were over the south-central part of the state. Much more significant convection triggered over the St. Louis area."*

- More details on HWT participant interaction with the Gridded NUCAPS data can be found on the HWT GOES-R PG blog: http://goesrhwt.blogspot.com/

SUMMARY

A collaborative effort between SPoRT, CIMSS, CIRA, GINA, and NOAA has produced a unique gridded visualization of real-time CrIS/ATMS sounding products. This product uses the NUCAPS retrieval algorithm and polar2grid software to generate plan-view and cross-section visualization for forecast challenges associated with cold air aloft and convective potential. Forecasters at select partner offices have been able to view the Gridded NUCAPS products in AWIPS alongside other operational data products with generally favorable feedback.

FUTURE WORK

- Cold air aloft evaluation kicked off on December 6; have already received valuable feedback from forecasters which will be further investigated by the researcher collaborators on this project
- Feedback from forecasters on the visualization will be used to updated the methodology for how the data are displayed in AWIPS for follow-on assessment at 2017 HWT
- Plan to work with AWIPS developers to baseline capability for gridding NUCAPS soundings that are already in AWIPS for a broader implementation across the NWS

ACKNOWLEDGMENTS

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